SOLAR
STILL

CONTEXT STUDY

"Designing a sustainable solution to hinder the transmission of COVID-19 in refugee camps in Greece"

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1.2 Preliminary Research

1.2.1 Our challenge

During this project, we will focus on the question: "How can we design a physical, sustainable solution - a prototype technology - that hinders the transmission of COVID-19 in the Greek refugee camp Moria?"

The main goal of our design will be to minimise the transmission of COVID-19 in camp Moria. We have decided to focus on this camp because transmission prevention is incredibly tricky there. This is due to the fact that large groups of people live in cramped, unhygienic conditions (Welle & Schmitz, 2020). The reason that we chose camp Moria specifically is that it is the largest refugee camp in Europe (Welle & Schmitz, 2020).

In camp Moria, social distancing is virtually impossible. The Greek refugee camp is built to house a maximum capacity of 3000 people. However, the population in Camp Moria is much larger (BBC, 2020). This means that thousands of people share restrooms and showers with each other, and tents are very closely packed. It is also impossible to wash one's hands regularly, because the queues are incredibly long. This is due to water shortages in the camps.

Although reducing the transmission of COVID-19 is our end-goal, we will also focus on sustainability when working on our design. The pandemic has resulted in a sudden surge in usage and production of plastics for PPE. Management of plastic waste was a problem before the outbreak, but the expected amount of waste due to COVID19 will

far exceed the available capacity for plastics and hazardous medical waste. This is illustrated in figure 2 (Klemeš et al., 2020)
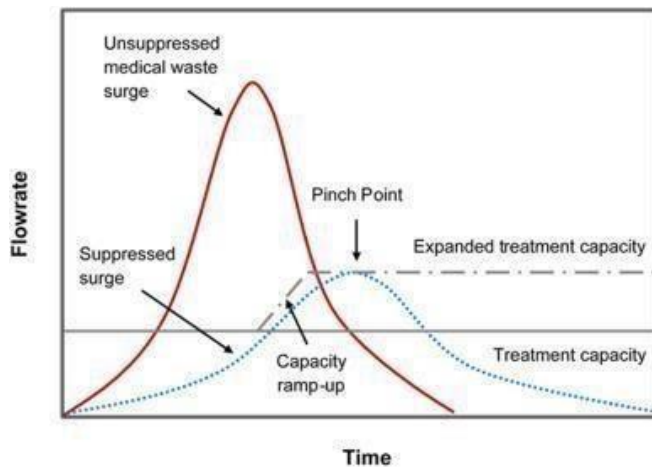

Figure 2 Expected amount of waste (Klemeš et al., 2020)

We use a model to define different aspects of sustainability. This model divides sustainability into three dimensions: environmental, social, and economic sustainability.

Figure 3 Sustainability diagram (sustainable development, n.d.)

This diagram describes how the three dimensions are connected. Sustainability can only be reached if all three dimensions are sufficient. Hence, when designing a solution, problems in all three dimensions must be addressed.

There is no set definition for social sustainability, although it is frequently used in literature (Lee & Young, 2019). Boyer et al. (2016) believe that the lack of definition is because social sustainability is context-specific. One of the descriptions given by McKenzie (2004) is: "Social Sustainability is a positive condition within communities

and a process within communities that can achieve that condition." Several indicators describe those conditions according to McKenzie.

These indicators include:

- Equity
- Diversity
- Political participation, preferably on a local scale
- Cultural relations
- Community ownership and responsibility
- Mechanisms in case not all needs are met by the community. (This can be the case for subjects like education)

Thus, social sustainability is related to the general wellbeing and quality of a group or community. Besides the indicators given by McKenzie, this involves the extent to which individuals can meet their basic needs and have the capabilities they have. Upon that, it has to do with how positively individuals perceive the society they live in. Hence, we should ensure that our design has a positive impact on the wellbeing of refugees in camp Moria(Magee et al., 2012).

Economic sustainability is generally about creating a maximum profit, with resources that are as cheap and efficient as possible(Durant et al., 2015). It should be considered that the situation in camp moria is similar to that of a developing country. This means that economic sustainability changes. In this case, when designing something sustainable for this specific stakeholder, the goal will be to reduce inequality, thus making sure the cost and benefits are in balance (Popovic et al., 2013). Therefore it is more important to design something that reduces inequality and can be bought by everyone than it is to attain maximum profits.

Environmental sustainability can be described as the use of resources, waste, and direct utilities (Durant et al., 2015). Additionally, producing a minimal amount of greenhouse gas emissions is part of environmental sustainability. In the context of camp Moria, these factors mean that the product should be assembled closeby, with local resources that generate a minimal amount of non-degradable waste.

The focus in Greek refugee camps is survival and protection, so sustainability is not high on the priority list of residents and authorities (Norwegian Geotechnical Institute & Eckbo, n.d.). The water that is provided in the camp is almost exclusively provided in disposable plastic bottles. These bottles are only used once, and the plastic waste it produces is not being recycled. This has an immense impact on the environment, as it leads to huge amounts of plastic waste (Norwegian Geotechnical Institute & Eckbo, n.d.). Therefore, we must take environmental sustainability into account when we are designing our product. We intend to minimise plastic usage but will ensure to use more sustainable types of plastic when we do.

In short, our goal for the project is designing a product that will minimise COVID-19 transmission in Greek refugee camps. During the design progress, we will focus on environmental, social, and economic sustainability.

1.2.2 Required information and relevance

Our challenge essentially consists of two parts: minimising COVID-19 transmission and sustainability. Therefore, we need to gather a lot of background information about

those two themes. In this section, the required information for both categories, as well as its relevance, will be summarised.

1.2.2.1 Minimizing COVID-19 transmission

To minimise COVID-19 transmission, we need to understand COVID-19 transmission. Therefore, we must do a lot of background research about how the virus can spread from person to person. To achieve this, we will study subjects such as virology and epidemiology. Iordan will work on this for his deepening, but we will make sure to all have a basic knowledge of these topics. If we understand transmission, we will be able to think about ways to reduce it.

Furthermore, we need to be very aware of the situation and organisational structure within camp Moria. The circumstances are vastly different than the ones we know and are accustomed to. We need to consider that the options for specific infection prevention methods, such as social distancing, are minimal. Additionally, identifying the main issues with transmission prevention within these circumstances will equip us to find solutions for them

1.2.2.2 Sustainability

To create a sustainable design, we need to be aware of the factors that influence the sustainability of a product. To achieve this, we will investigate sustainable materials. Femke will focus on the chemistry of biodegradable plastics for her deepening since there is a chance that at least a part of the product will contain plastic. Aditionally, we

will investigate alternatives to plastics to ensure that we choose the most sustainable option. Furthermore, the material needs to be relatively cheap, so that the economic sustainability can be achieved.

The second component of an environmentally sustainable design is a sustainable production process. This means first waste that is difficult to dispose of must be limited. Additionally, the greenhouse gas footprint should be kept to a minimum. We will thus investigate alternative production methods and research on how companies have achieved carbon neutrality and have limited waste so that we can learn from their methods.

 Lastly, we will look at the ways our product can be recycled. Our product may generate an amount of plastic waste. We will also explore waste disposal methods. Thereby, we ensure that our product will not add to the current excess of waste (Klemeš et al., 2020). During this process, we will also research economic and social sustainability. Thus, we will be sure that our final product suits our stakeholders and their capabilities, and that the product can be produced cheap, so it stays accessible for our intended users.

1.2.3 Conceptual and theoretical elements

Several concepts and models have influenced the framing of our challenge. We have been introduced to the theories in the project lectures and through individual research. In this section, the most prominent theoretical elements and their influence on our challenge will be discussed.

1.2.3.1 Design ethics

During the design process, it is vital to consider the wanted and unwanted mediations of an artefact (Gonzalez Woge & Sivakumar, 2020a; Verbeek, 2006). We will therefore consider the unexpected or even undesired mediations that may come with our design and use these considerations to limit adverse mediation effects. Furthermore, our primary goal will be to design something that can be used for positive mediation.

1.2.3.2 Technological mediation

Technological mediation concerns the role of technology in the experiences and actions of individuals and groups. In practice, this means that people can use artefacts to connect with their environment. They can also use technology to a particular end.

Often, the technology at hand influences the action an individual chooses to take (Gonzalez Woge & Sivakumar, 2020a; Verbeek, 2006).

Building on this concept, we will make sure that we are aware of the mediations that come with our design. We will aim to design something that actively influences the behaviour of individuals, in which our goal is to stimulate the use of transmission prevention methods.

1.2.3.3 Hard and soft impacts

Soft impacts are how our solution affects relationships between people and the norms and values of a society. Hard impacts relate to more functional aspects of our solution, such as how it will affect the environment or economy.

1.2.3.4 Capability approach

We have been introduced to capability centred design in one of the project lectures and the corresponding reading. A core concept within the capability approach is that every individual should have access to ten basic capabilities (Gonzalez Woge, Sivakumar, 2020b; Oosterlaken, 2012).

We will design for life and bodily health by decreasing the transmission of COVID-19 within the refugee camps. We will also create for other species, which means that we will make our design as sustainable as possible. Furthermore, we are designing for senses, imagination and thought. Finally, we will design something that stimulates the control over one's material environment, meaning that we will try to increase the availability of PPE. We will have to make sure that we design an artefact that is not only good but also appropriate for our stakeholders and their capabilities (Gonzalez Woge, Sivakumar, 2020b; Oosterlaken, 2012).With every iteration, we will make sure to reflect on the potential soft and hard impacts and their moral implications with the knowledge we gain from existing solutions. This is essential to ensuring that the system or product we develop is sustainable in the context of its use. Therefore, in the following chapters there will be given more insight in these concepts and models and how they apply in the context of our challenge.

1.3 Urgency of our challenge

To say that refugees in camp Moria experience stress is a profound understatement. They must deal and cope with migration, war, oppression, forced detention, violence, and witness death and destruction. They suffer abuse from smugglers, criminals, and governments' (Papadimos et al. 2020). They are exposed to poverty, abuse from locals and fellows, to human trafficking, rape, malnutrition, and inhumane living conditions.

Disease, insects, cold, uncontrolled amounts of waste, impure water, congestion, and increased sexual abuse have led to violence in camp Moria. Almost 13.000 people were left homeless after their camp was burnt down to ashes. There are frequent clashes, riots, and increased incidence of violence, where 72 people would share a toilet and 84 people - a shower (Pazzano 2020); during a global pandemic, where almost a million people lost their lives (WHO Coronavirus Disease (COVID-19) Dashboard).

The situation is so dire that children as young as ten years old are attempting suicide. (Katy Fallon and Peter Beaumont 2020).

The international public health community is concerned about childhood morbidity in the refugee camps of Greece. Kampouras was one of the first groups to investigate and report on the disease burden of camps among children. They divided the illnesses that occurred over the winter of 2016–2017 into infectious and non-infectious categories. Children less than the age of 12 years were usually presented with infectious causes (nearly 81%). The most common infections in younger patients included infections of

the respiratory tract (67%) (Kampouras et al. 2019, pp. 6(3)). This report only shows the disastrous potential an outbreak of COVID-19 can have in camp Moria

By 2020, the total number of refugees who had travelled through the island, Lesbos - one of the biggest points of transition for refugees in the world, was close to one million, which is an enormous number for an island with a population of 90,000 people. In early 2020, it held about 20,000 people, whereas its facilities had been designed for fewer than 3,000 people (Jussi 2020).

This case illustrates how extremely vulnerable people are neglected in times of severe economic, social, and political challenges and distress, such as the COVID-19 pandemic (Jussi 2020).

Refugees in camp Moria are left unprotected against the life-endangering coronavirus; they do not have access to the necessary medical services provided by the state and other authorities. They do not have proper shelters. Thousands of them live in tents packed with four to ten people. They have minimal access to water and sanitation. They live in deplorable conditions and overcrowded places, so they cannot keep social distance; they do not have hand sanitizers, facemasks, or even the needed medicine to treat a simple cold. An outbreak of COVID-19 in camp Moria can have devastating consequences and can result in a disproportionate amount of life loss and suffering.

It is for all these reasons that urgent and immediate action needs to be taken. Therefore, the design of a solution that prevents the transmission of COVID-19 in camp Moria is indispensable.

1.3.1 Existing initiatives

The WHO reports that "in a catastrophic fire that broke out on 8 September 2020, the Moria reception and identification centre for asylum seekers and refugees in Lesvos, Greece, was burned to the ground. The world turned its attention towards the Greek island as some 12 000 refugees and migrants were left without shelter, food, or access to health-care services. With 35 refugees and migrants having tested positive to COVID-19 a few days prior to the fire, the situation was particularly urgent, calling for immediate action and coordination" (Author not specified 2020).

The specialized agency of the United Nations responsible for international public health has coordinated great efforts in response to this humanitarian crisis. European organisational bodies and Greek authorities (Greek National Public Health Organization (EODY) taking the lead) have mobilised on the ground trying to maximise their impact. A tended living structure is already being established in efforts of providing refugees with a substitute for shelter (Author not specified 2020).

"A total of 22 team members, including medical doctors, nurses and paramedics of diverse specializations, have worked with local authorities and health professionals to triage, test, isolate and treat COVID-19 patients at the new site and to provide medical support to people in need. The WHO's background work to make this happen ranged from customs clearance for shipments of medical supplies and equipment, organization of their transportation and storage, coordination of initial briefings on security and public health, and provision of Farsi and Arabic interpreters" (Author not specified 2020).

This clearly underlines the hard work the WHO is performing these days. However, there is no clear indication of the efforts to prevent the transmission of COVID-19 within the newly established living structure. This is a tremendous shortcoming and unfortunately, it is not unprecedented. Similar shortcomings could be observed in the camp before the ongoing tragedy.

The international community has the alarming tendency to handle the situation in Moria reactively. On a European level, intentions to restructure the system in order to improve the living conditions of asylum seekers seem to lose velocity, mainly due to friction forces between European and national law as precisely analysed by the University of Maastricht.

"The initial implementation design of the EU's asylum policy fores[ees] that Member States would realise the Common European Asylum System (CEAS) largely through deploying their own resources. Initiatives [⋯] follow [⋯] emergency-driven trajectory of intra-EU solidarity, rather than structurally embedding solidarity and fair-sharing of protection responsibilities into the EU's asylum policy. Until there is a permanent redesign of the CEAS, it will arguably be impossible to realise the legally binding principle of solidarity and to ensure human health and dignity, in the time of coronavirus and beyond" (Tsourdi 2020).

On Tuesday, 15 September 2020, Germany announced they would evacuate 408 families from Moria, rescuing in total 1,553 individuals (Noticas 2020). In the meantime, Greece reported the first person in Moria's refugee camp to have fallen

victim to SARS-CoV-2 (Koutantou 2020) - a 61-year-old male. Even though Germany's action contributes to resolving this humanitarian crisis, other Member States seem to be very passive when it comes to their involvement in constraining the outbreak of COVID-19 in camp Moria.

However, this is not an insight that applies only to European bodies. In the undertaken research, the lack of initiatives with regards to hindering the transmission of COVID19 in Moria and other refugee camps is alarming. International and non-governmental bodies focus on how to milden the consequences of the outbreak, instead of reducing its magnitude.

Hence, the real challenge is that initiatives do not address the cause of potential outbreaks – which is indeed the greatest shortcoming. This can result in disproportionate life loss and suffering.

It is important that this fact is not confused with improper action or inaction of the previously mentioned organisations. Many ongoing initiatives address the mental wellbeing of asylum seekers (Refugee Trauma Initiative 2020), the housing emergency situation on Aegean islands (European Commission Initiative 2020), the educational infrastructure for children from refugee families (Theirworld's in collaboration with Nationale Postcode Loterij and Education Cannot Wait 2020), the provision of medical supplies, treatment or nutrition (WHO, UNICEF, UNHCR 2020) or the provision of statistical data about COVID-19 in refugee camps (Greek Impact Initiative 2020).

1.3.2 Consulted resources

During this stage, different resources were used to gain an overview and better understand the identified challenge. Peer-reviewed literature, quality-journalism and social media posts were consulted to properly depict the situation on the ground.

Different databases with scientific papers created by many experts were taken into consideration, the reliability of quality journalism sources was examined, and social media posts from different sources were considered. A list with used references is provided at the end of this document.

One of the defining scientific elements of the framework of this design challenge will be the reconceptualization of sustainable development and its relationship to the capability approach (Lessmann and Rauschmayer 2012). We will use this model to relate the capabilities we design for to the different dimensions of sustainability of our solution. In establishing this relationship, we will consider different relevant standard regulations and how specific requirements and functions respond to them according to the Value Sensitive Design recommendations by van de Poel (2013).

By considering these scientific frameworks, we will ensure that our design challenge solution is largely driven by the needs and capabilities of our stakeholders - securing standard quality following specific norms and scientific approaches towards sustainable product development and transgenerational justice (Lessmann and Rauschmayer 2012).

1.3.3 What do we want to research in the limited time you have?

As we only have a single semester to work on this project, it is imperative that we carefully prioritise what we research. Now that we have a more in-depth understanding of the social and technical aspects of our design challenge, we want to study how a disease spreads within the context of an overcrowded refugee camp. A deeper knowledge of the dynamics at play within the epidemiological situation in refugee camps in Greece would inform us on how we can reduce the transmission of Covid-19 most effectively.

We also know that it is essential that we reach out to people who are close to the problem. This could be refugees, local and national authorities, the European Union, or any other working forces who are closely linked to Covid-19 in Greek refugee camps. Our current leads include:

- The Hellenic National Public Health Organization (EODY) who are in charge of surveillance and control of infectious diseases in Greece (European Centre for Disease Prevention and Control, 2020)
- Legal Centre of Lesbos
- Existing Initiatives on providing people in crisis situations with drinking water
- The World Health Organisation
- NGOs: Doctors without Borders, Caritas
- Local authorities of the asylum process department

We also want to conduct further research in the fields of economics, chemistry of polymers and product design and prototyping as these topics will help us to design a solution that is economically, socially, and environmentally sustainable.

1.4 Design Ethics and Technological Mediation

1.4.1 Technological Mediation

Design Ethics can be thought of as a set of ethical standards or considerations which concern "moral behavior and responsible choices in the practice of design" (Buchanan, 2020). Technological Mediation is a theory linked to Design Ethics which suggests that technologies alter the way in which humans act within their environment, as well as how they experience it. This theory suggests that technology plays an active role in what we do and how we do it, which is known as the existential dimension of a technology. Furthermore, it plays an active role in how we sense the world around us, which is known as the hermeneutic dimension of a technology (Ihde 1990; Verbeek 2005, 2011). The framework of technological mediation allows us to acknowledge and analyze this role.

We need to predict, as best we can, the changes in behaviour or experience brought on by our solution. This means we must have an in-depth understanding of the people who will use our technology and take a critical stance throughout the design phase on how our technology could negatively affect these stakeholders, especially when it comes to long-term use. The primary concern of our solution will be slowing the spread of coronavirus in refugee camps such as Moria Camp in Greece. However, we must understand that any technological fix may have unforeseen consequences. These

consequences can affect the refugees directly (such as a PPE made from an irritating or slightly toxic material) or indirectly (such as a solution that is not economically sustainable and results in further financial problems for the government or NGOs working locally).

According to Akrich (1992) and Latour (1992), designers inscribe instructions in the technologies they create, explicitly or implicitly. These inscriptions make up a "script", which prescribes certain behaviours to an "actor" or those who interact with the technology. The user may follow some or all of these instructions, though not always in the way that the designer intended. These ideas are very useful in helping us think about how to best achieve our goal. For example, a face mask has a built in script, which tells the wearer not to cough or sneeze into their hands. This is the existential dimension of the technology. When a large proportion of the people we see in our daily lives are wearing masks, it may remind us of the presence of the virus (this could then indirectly affect our actions by making us more careful etc.). In this sense, masks change how we view the world. This is the hermeneutic dimension of the technology.

So how would script affect how we design our solution? If we wanted a face mask that prevents the user from touching their face, we would design the mask so that it can be adjusted to fit different sized heads comfortably, therefore reducing the wearer's impulse to constantly adjust the mask while wearing it. If we wanted a mask that reminds people to be wary of spreading the virus, we could ensure that the masks are brightly coloured (of course the number of people wearing the masks would have a larger effect, but accessibility and implementation of our design will come later).

Our priority for the design, is that it slows the transmission of coronavirus in camp Moria in a way that is sustainable. It is important then, to define what we mean by sustainability. A technology will have soft and hard impacts (Verbeek, 2015). Softs impacts include how a technology affects the norms and values in a society. We want to understand the context of our design's use, as well as the different cultures within the refugee population in camp Moria, in order to minimize any negative impacts of our design on culture (note that phenomena affected by soft impacts change more slowly than those affected by hard impacts). Hard impacts have a more quantifiable risk. They affect things like unemployment, health, and the environment. By taking a critical stance on the soft and hard impacts, we will make our design as sustainable as possible within the context of its use. Here is a model describing the relationship between our stakeholders and and our design
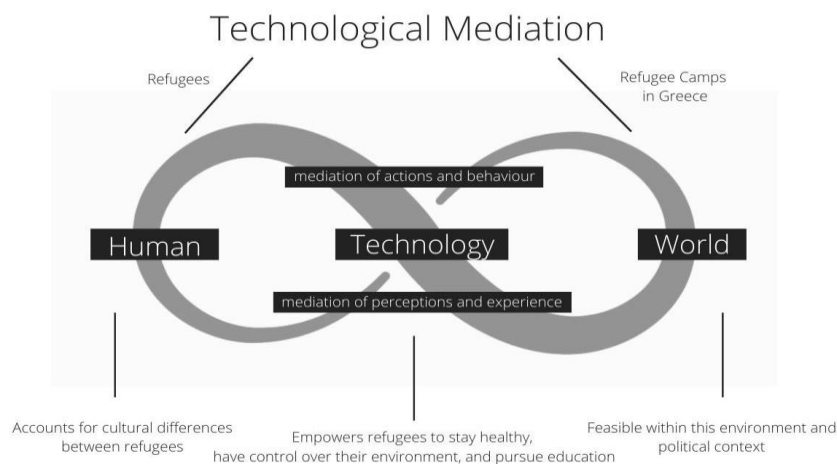

Figure 4. Technological mediation.

The point of this model is not to represent concrete causal relationships between the variables, but to acknowledge and visualize the dynamic flow across the variables. The

lemniscate represents the intermediation of humans, technology and their environment. In other words, it shows two things:

- how humans affect the world using technologies (in this case tools that increase abilities like motor and cognitive functions)
- how the world affects humans through technologies which actively shape our perceptions and hence, shape what is considered to be "objective" (telescopes, infrared cameras etc.)

1.4.2 How will the interplay of these elements inform our design?

We must understand the cultural differences between refugees so that we can design inclusively and understand whether or not our design is appropriate in the context of its use (Oosterlaken, 2012).

We want our technology to facilitate the capabilities (Nussbaum, 2002) of refugees, without pushing our own priorities on them. In other words, our aim is to create external conditions that allow the refugees to keep themselves and others healthy, and to use their senses, imagination, and freethought to pursue education. We aim to do this in a way that does not decrease the already low level of financial control they have over their material environment.

It is also important that we understand the constraints of the specific environment in which our technology will be used. For example, asylum-seekers do not usually have the luxury of social distancing or owning smartphones, so designing a Covid-19 tracking app for use in refugee camps in Greece would be pointless. Also, Greece itself has large-scale financial problems. Without knowing this we would not be able to effectively find long-term funding for our solution.

1.5 Capability Sensitive Design

1.5.1 Stakeholders

In Camp Moria 2.0, there currently live around 12000 people (Oxfam, 2020). According to Infomigrants (2019) there are presently a total of 70 different nationalities living in Camp Moria. The latest site profile published by the United Nations Refugee Agency is from September 2018. Here it can be found that around one third of the population is from Afghanistan, about 20% is from Syria and 11% comes from Iraq. On the 9th of October 44% of the population in Camp Moria are male adults, 22% are female adults, and 34% are children (Oxfam, 2020). More in-depth information about the stakeholders and their context can be found in Kayla's deepening.

Oxfam (2020) warns people about the inhumane living conditions in the new Camp Moria. According to them, food is only handed out once or twice a day, and there is a lack of running water, to use for both washing and drinking. During COVID-19, the World Health Organization's advice is: "wash your hands regularly, keep distance and self-isolate." All of these seem to be nearly impossible for refugees in camp Moria. People are sharing a water tap with up to 250 people (Oxfam, 2020a,). They usually do not have more than 3,5 square meters per person (International Refugee Committee, 2020), and live with up to 20 people in a single container or tent (Oxfam, 2020a, June 5). Furthermore, due to the lack of food and water, refugees must queue all day every day, making it impossible to keep 1.5-meter distance. This severely increases the

chances of getting COVID-19 (International Rescue Committee, 2020). Therefore, a solution to reduce the queues in camp Moria need to be found.

1.5.2 Sustainability and capabilities

1.5.2.1 Sustainability

When tackling the challenge ("How can we design a physical solution - a prototype technology - that hinders the transmission of COVID-19 and is sustainable and available globally?") there will be looked at a sustainable way to reduce the transmission. To describe sustainability, the sustainability diagram is used, as shown in chapter 1.2.1.1.

In the case of our stakeholders, the most relevant thing is social sustainability. Firstly, it will be made sure that the situation of the stakeholders is fully clear. This gives the opportunity to make the solution socially sustainable. More information about social sustainability and its concepts can be found in the deepening about stakeholders.

1.5.2.2 Capabilities

Capabilities are part of the Capability Approach, which is set up by Amartya Sen and Martha Nussbaum. Nussbaum (2007) describes the Capability Approach to measure human well-being and human development. This information can advise policy makers, instead of using GDP. A way to figure out how social sustainability can be improved, is to look at what capabilities have been lost. These capabilities will show problematic areas. To use the Capability Approach in such a way, Nussbaum created a

list of ten capabilities. The most harmed capabilities in times of COVID-19 in the case of camp Moria are:

1. Life. Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living.
2. Bodily Health. Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.
3. Other Species. Being able to live with concern for and in relation to animals, plants, and the world of nature.
4. Control over One's Environment. Material. Being able to hold property (both land and movable goods) and having property rights on an equal basis with others.

According to Nussbaum (2007), the goal is to give every human on earth a minimum of those capabilities. From there, countries can start developing towards even better standards. For the refugee camps in Greece, these capabilities were already not being met, but now during COVID-19 the situation has gotten even worse. This has affected some capabilities.

Life and Bodily health

Firstly, and most importantly, is the harm towards the capabilities of "Life" and "Bodily health". The immensely high transmission rates and the lack of proper hospitals and health employees has caused the capabilities "Life" and "Bodily health" to be in danger.

Since there live around 204 people per thousand square meters in camp Moria (International Rescue Committee, 2020), the hazard towards these capabilities grows even bigger. Not only do people die from the virus, they also suffer long-term, or in some cases even life-long, consequences of the virus. A modelling study done by

Tucker Gilman et al. (2020) shows the consequences of a big outbreak in Camp Moria when no measures are taken, for both high and low transmission.
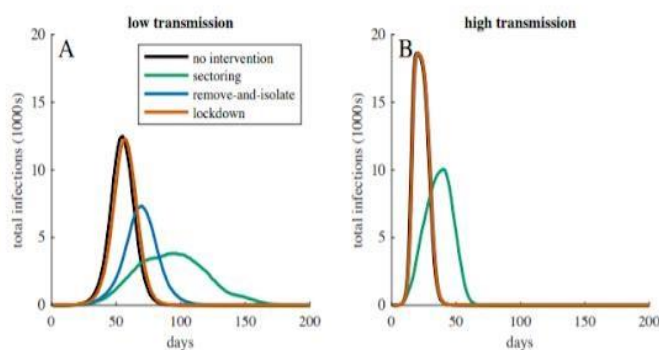

Figure 5: Total infections over time (Tucker Gilman et al., 2020).

With such a rapid spread it is even more difficult to isolate infected groups. Additionally, according to Jervelund et al. (2019), it was not possible to meet the medical needs of the refugees even before COVID-19. This means that if such a big outbreak occurs, it will be impossible to help all the refugees properly. Furthermore, due to the need to stand in queues for water, where it is relatively easy to get COVID19, this capability is harmed. Lastly, once the virus starts spreading through the camps, all control will be lost and thus the capability of Life and Bodily Health is in big danger.

Other species

Even before COVID-19, refugee camps were harmful for the environment. Now it is getting even worse, due to COVID-19. To stop the transmission of COVID-19, equipment like bottles with soap or hand sanitizer and disinfecting wipes are handed out (UNICEF, 2020), all including plastics. Also, the water distribution system, where plastic water bottles are handed out to everyone, has a big environmental impact. With the current population it means that around 12 000 plastic bottles a day are handed out (International Rescue Committee, 2018). It gets even worse when taking into account

that these bottles take 450 years to biodegrade (WWF, 2018). Looking at Sustainable development, this threat towards the environment has an influence on environmental sustainability.

Control over one's environment (Material)

This capability is being especially harmed during times of COVID-19, due to the lack of medical supplies and protective equipment (International Rescue Committee, 2020). Besides that, due to the queues and lack of water (Oxfam, 2020) there is no possibility to have equal amounts of water for everyone. According to the International Rescue Committee (2018) refugees had to queue for four hours to get 1,5 liters of water in the old camp. Looking back at sustainable development, this means that in the field of economic sustainability something needs to change to decrease inequality.

Looking at the ways these capabilities are harmed and how COVID-19 can spread to the camp, it can be concluded that there needs to be found a way to ensure water distribution without queues. When such a solution is sustainable it will also contribute to the capability of other species since there will be fewer plastic bottles and there will be less need for single use PPE. This also positively influences the capability of control of one's environment since people have a more equal access to water and PPE is not as necessary as before.

1.5.3 Designing an appropriate technology

Designing something that accounts for human diversity is essential. If not, something great can be developed, but there might be a chance that the intended user is not able to use it. This means it is important to think about the user and their context, otherwise it will never expand one's capabilities.

1.5.3,1 Defining an appropriate technology

Firstly, appropriateness does not have a single definition, it can be seen in many ways, mostly depending on its context. In the light of appropriate technology, synonyms used can be: "suitability, fitness, applicability and usefulness" according to Oosterlaken & Hoven (2012).To fully understand appropriateness and what it means for technology, there are several things to consider. All these things are summarised by Oosterlaken & Hoven (2012) in their book: "The Capability Approach, technology and design". This will be used as a guideline to design a solution during this project.

Human diversity

First, it is essential to take human diversity into account. According to Houkes and Vermaas (2010), aside from judging the material for a certain function of a technology, the plan of usage should also be considered. The plan of usage should account for the capacities and circumstances of the user. This leads to the insight that technology or a specific solution will never be appropriate for everyone, and it only gives opportunities to help a particular group.

Good-, poorness and (in)appropriateness

A technology can be good or poor. It can work well or not. This is something different than appropriateness. According to Franssen (2006, 2009) poor or good is relative to the expectations about the stakeholders and context. Those ideas exist of the properties of such a technology, and those are related to the assumed abilities. This is related to their actual abilities. Here the difference between goodness and appropriateness can be made clear. Something can be good, meaning itis functioning well. This can be said regardless of whether the real abilities match the function of the technology or not. That does not really matter, because the technology can still be a good technology. When something is appropriate, the assumed abilities will match the real abilities. So, the user will be able to use the technology.

Balance of reasons

It can be that something is poor but appropriate or good but inappropriate. The best pick in this case depends on the definition of both poor and good and appropriate and inappropriate. This is dependent on human diversity. Something can also be useless for a certain goal; this can be the case due to the circumstances or capacities. This is something completely different than whether it is inappropriate or poor. When such a thing happens, something is extremely inappropriate.

Moral judgments

Lastly, moral judgments play a role as they might have implications with the safety of a certain technology. A safer technology would be considered as morally better. The same can be said about appropriateness; if something is appropriate for a bigger group of people, it can be argued that it is morally better. This only happens when this technology is important to people, so then people will not like it if they cannot use it.

The meaning of this is that, when looking at new technology for a specific stakeholder group, it is important to consider human diversity. Hence, the next step is to look at the capabilities and context of the user. Upon that, it should be considered whether the technology is good/poor and/or (in)appropriate and how much this influences each other. For example, how poor is poor? Next to that, there also needs to be thought about whether a certain technology is not useless, because this gives a good argument for the intended users to not use it. The last important step is to argue about the moral side of appropriateness. All these concepts give a guideline when designing technology. Keeping an eye on them is extremely important to deliver the right solution. Without these concepts, essential things can be overlooked, which will end in a failed design.

1.6 Responsible Research & Innovation

1.6.1 Visual inspiration

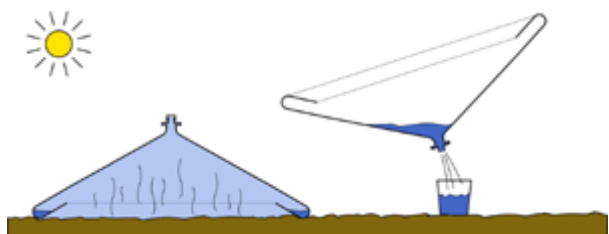The designs in figure 6 and 7 have inspired us when looking for a solution that fits our stakeholders
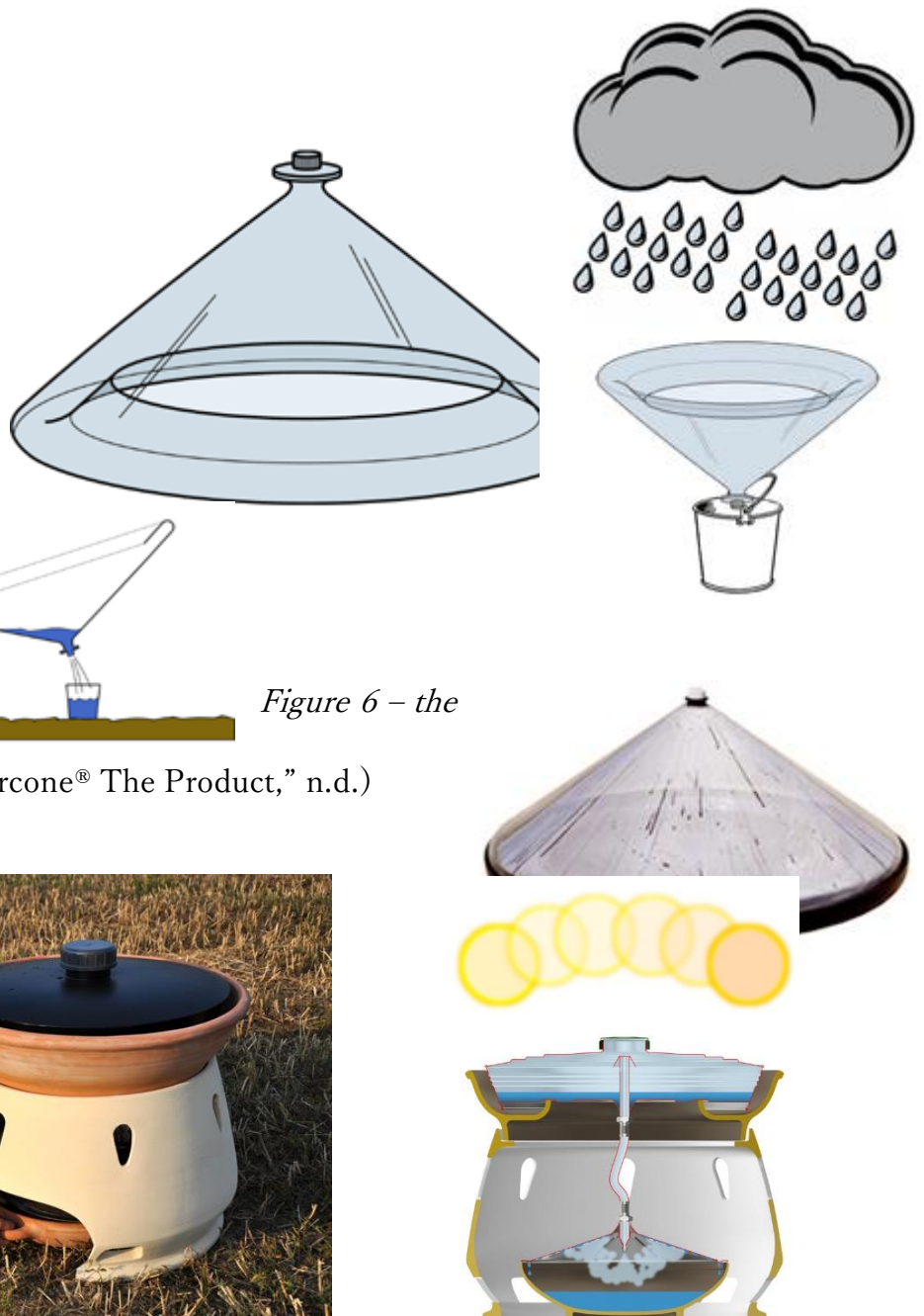

Figure 6 – the watercone system ("Watercone® The Product," n.d.)

Figure 7 - eliodomestico ("Eliodomestico desalinates seawater into drinking-water running on solar power | DesignAgenda," n.d.)

In these visuals, the solar power desalination systems are shown. These products turn sea water or brackish water into drinkable water, using nothing but the warmth of the sun.

1.6.2 Suitability

The Watercone system inspires us to create a solar powered distillation system that suits the needs of the refugees in camp Moria. In that way, the lines for water distribution can shorten, which will lower transmission rates. Furthermore, there will be more access to clean drinking water and water to wash their hands with, which improves their general living situation.

To make this solution as appropriate as possible, we have considered the following adaptions to the design:

- Making it square, so that it can be stored more easily
- Using cheap materials, in order to keep the product affordable
- Using biodegradable or recyclable plastics, to reach environmental sustainability

We combine the knowledge we have about our stakeholders with the inspiration we got from the Watercone system. Thus, we can create a sustainable solution that helps reduce COVID-19 transmission in camp Moria, as well as improving the overall quality of life of the refugees.

1.6.3 Principles and regulations

The niche that shapes our challenge is healthcare, related to COVID-19, in refugee camps. We want to shape and improve healthcare, related to COVID-19, by designing a prototype technology that hinders the transmission of COVID-19. This technology must reduce the queueing for drinking water.

Universal health is a human right, which shapes the niche that we are trying to innovate in. The WHO states that understanding health as a human right creates a legal

obligation on states to ensure access to timely, acceptable, and affordable healthcare of appropriate quality, as well as to providing for the underlying determinants of health, such as safe and potable water, sanitation, food, housing, health-related information and education, and gender equality (WHO, 2017).

The standards used by the UNHCR, the UN refugee agency, are from the Sphere. "The Sphere Minimum Standards for Healthcare are a practical expression of the right to healthcare in humanitarian contexts. The standards are grounded in the beliefs, principles, duties, and rights declared in the Humanitarian Charter. These include the right to life with dignity, the right to protection and security, and the right to receive humanitarian assistance based on need." ('Sphere Handbook Health Standards', 2019) The list of SPHERE standards on health can be found Appendix A.

These are the SPHERE standards that the UNHCR claims relate to refugee camps (UNHCR, 2020). If these cannot be met, as can be seen in prior sections due to shortages in for example well trained medical staff, this will severely influence the capability of Life and Bodily Health.

Besides that, water is an important underlying determinant of health. According to the SPHERE standards (Sphere Association, 2018), everyone should have a water distribution point less than 500 meters away from their household, as well as less than 30 minutes waiting time. This is something that is not happening in Camp Moria. Therefore, these standards are not met and thus people do not have equal access to water.

Furthermore, refugees only get 1,5 litres of drinking water a day, while the SPHERE standards suggest a daily quantity of 2,5 to 3 litres. This means that the refugees do not have equal access to water compared to people that do not live in Camp Moria. Hence, the capability of control over one's environment is harmed.

Lastly, the SPHERE standards (Sphere Association, 2018) strive for environmental sustainability with regards to one's household. Here one of the key indicators is that at least 70% of the solid waste onsite should be reused, repurposed, or recycled. This is definitely something that is not done with, for example, the plastic bottles in camp Moria. Therefore, camp Moria is currently hurting the environment, and thus the capability of other species cannot be met.

The low living standards at the refugee camps are an issue that needs to be addressed. Therefore, the information available on this capability, together with the standards, should provide guidelines for different policy makers, such as the Greek Government and the European Union, on how and what to do. If these standards can be met by their effort, the quality of life will be raised, and the minimum capabilities will be met. We should also do everything that lies in our power to better these living standards. To design a prototype technology that hinders the transmission of COVID-19 is a good first step to stabilize the situation in camp Moria, so we can work on improving the overall living conditions the camp in the future.

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